GOLDEN GATE PARK

MASTER PLAN

Background Report: Forest and Wildlife

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INTRODUCTION

The purpose of this report is to provide a resource for participants in the Golden Gate Park Master Plan project on long-term issues of forest health, condition, reforestation and safety. In addition, current issues of native plants, wildlife and wood debris are discussed. This report is the product of Phase I of the Master Plan Update project. In Phase II, the potential modifications, recommendations and updates to the Master Plan will be addressed in detail.

The report is organized as follows:

1. **INTRODUCTION:** Discussion of the approach to the analysis, summary of findings and summary of issues.

2. **IMPLEMENTATION OF PARK PLANS:** The status of implementation of objectives and policies of the Plan for Golden Gate Park (1979) is reviewed. Implementation of the recommendations of the Golden Gate Park Forest Management Plan (1980) is then discussed.

3. **CURRENT CONDITIONS:** Provides observations regarding the park's forest landscape, including the reforestation program, native plants, wildlife and wood debris.

4. **FOREST INVENTORY:** Describes the Park tree inventory being conducted by the California Department of Forestry.

ANALYSIS APPROACH

This report is the product of the following analysis approach:

- We reviewed data, reports and correspondence relating to forest and wildlife in Golden Gate Park and identified gaps in the data.

- We worked with Recreation and Park Department staff in collecting additional data relating to vegetation and wildlife.

- We noted vegetation and wildlife conditions in the park.

- We met with members of the Native Plant Society and the Audubon Society on several occasions to elicit observations, concerns and opinions related to forest and wildlife issues.
- We reviewed the policies and objectives of the Plan for Golden Gate Park (1979) and the recommendations of the Golden Gate Park Forest Management Plan (1980) as to the status of their implementation.
- We organized the above information into this report.

SUMMARY OF FINDINGS

Golden Gate Park's most visible aspect--its beautiful forest and trees--is probably its most appreciated. The trees provide beauty, shade, habitat, windbreak and a more favorable climate in all areas of the park and during all seasons. Preservation and renewal of this treasure and its accompanying vegetation and wildlife is crucial to the continuing presence of the park as an oasis of tranquil beauty within the city of San Francisco.

The Golden Gate Park forest is the inheritor of intelligent planning and artful planting by its progenitors more than a century ago. However, the predominant tree varieties have a normal life span of about 100 years. If the forest is not renewed, its trees may begin to present safety hazards as they age, weaken, and die. Natural renewal of the forest is not likely in its present state. Nor is nature's method of disposing of dead, defective, and overmature trees through fire a feasible option for Golden Gate Park.

The San Francisco Recreation and Park Department, steward of Golden Gate Park, initiated reforestation following the recommendations of the Golden Gate Park Forest Management Plan (1980), which was based on Policy B, Objective II of the 1979 Plan For Golden Gate Park. The goal of the plan will continue to be the maintenance of healthy trees, the replacement of dead and dying trees, and the development of a healthy and safe forest.

Restoration of native species is to be accomplished in limited areas as designated in the Significant Natural Resource Areas Management Plan (SNRAMP), now in the draft stage.

Park wildlife is under severe pressure from changing park usage: Snag and understory brush removal limits habitat. Feral cats, fed by sympathetic visitors, prey on native animals.

Existing Plans Implementation

Of the five policies of Objective II of the Objectives and Policies of the 1979 Plan for Golden Gate Park, three have been fully implemented and two have been partially implemented. All eight elements of the 1980 Forest Management Plan have been initiated, although this ongoing program requires continuing attention. These programs are discussed fully in the second section of this report.

Existing Conditions

Ongoing reforestation efforts, in compliance with the Plan for Golden Gate Park (1979), follow the recommendations of the Forest Management Plan (1980). An inventory of park vegetation conducted as part of the Forest Management Plan (1980) found almost one-fifth of the forest in a dead or dying condition.

A new inventory, conducted by Stephen G. Smith and Park staff and compiled by the California Department of Forestry, is expected to be released in summer of 1993.

SUMMARY OF ISSUES

These issues are brief statements of concerns based on our synthesis of the data, or voiced by park staff and local citizen groups.

Landscape Renewal:

- The Park, specifically the forest, continues to decline due to age. Design values are being lost and older trees are becoming a hazard to the public. Reforestation efforts must continue in order to preserve the park design and maintain visitor safety. Reforestation will take time to reverse this condition.
- Parts of the Park landscape, such as the Chain of Lakes area, require special attention due to their advanced state of vegetation health deterioration and desired species loss.
- Understory shrubs throughout the Park need to be regenerated and maintained.
- Preservation of remnant native plants will be emphasized in designated SNRAMP areas, in accordance with the policies adopted by the Recreation and Park Commission.
- Eucalyptus forest is part of the Park's design and should be silviculturally managed within its historically designated areas.

Design Integrity and Design Management:

- Planting and maintenance should be in keeping with the original Park design. Responsibility for unity of design should be vested in a single individual with authority to see it through.
- Landscape design is deteriorating due to fragmentation of the Park by misdirected gardeners. Flower bed plantings in the western end are out of keeping with its naturalistic design and existing policy.
- Deciduous trees are out of keeping with the Park's basic evergreen design. This conflict needs to be resolved by the individual vested with design management.

- Special maintenance measures will be necessary to retain older specimen (heritage) trees in the landscape.

- Trees along roads, trails and high-use areas need to be encouraged despite their potential future hazard.

Staffing, Structures and Facilities:

- Park gardening staff has been cut 25 percent in the last five years. Adequate staffing must be maintained to follow through on landscape plans and policies and to ensure visitor safety.

- The Urban Forestry Center is an important facility, but needs upgrading and redesign to minimize negative impact.

- Salvage of Park wood debris is an appropriate activity for a wood recycling facility.

- Use of Park land for maintenance needs should be controlled. Existing maintenance facilities may be improved through redesign and/or vegetative screening.

Visitor Safety:

- Potentially hazardous trees need to be systematically identified, monitored and removed as necessary as part of an ongoing safety program.

- Underbrush which provides screening for illegal encampments or other undesireable activity should be managed to minimize threats to life or fire safety, while preserving wildlife habitat and urban screening.

Wildlife Enhancement/Animal Control:

- Maintaining wildlife habitats is important. This is part of the total Park experience, as well as an indicator of forest health, and must be taken into account in any planning.

- Snags should be retained for habitat, although this will create a certain amount of liability which must be managed.

- The Chain of Lakes area was set aside by John McLaren as an experimental area for the express purpose of wildlife development. This area has the most diverse wildlife habitat in the park, but the lake suffers from seepage problems that need to be addressed.

- Unwanted exotic plants such as ivy, landscape aging and general plant health decline have severely degraded wildlife habitat. Attention to plant life will improve animal life.

- Native plantings are important for some wildlife species and should be emphasized in appropriate (SNRAMP) areas.

- The existence of feral cats has diminished other wildlife populations. As a long term goal, the Park should seek to eliminate feral animals.

Wood Resources/Debris:

- Recycling of waste wood is considered desirable to meet soil and landscape needs.

- Recycling is considered the most desirable solution to waste wood disposal.

Irrigation, Water Quality:

- Water pressure and volume are often inadequate due to the Park's aging irrigation system. Consistent water pressure and volume is particularly a problem in reforestation plots, often located far from horticultural exhibits. This problem must be resolved.

- Use of reclaimed waste water is considered desirable for irrigation, but presents problems of plant toxicity and/or algae development, which must be taken into consideration.

Erosion:

- Erosion of footpaths is becoming more evident, particularly in areas of bicycle and equine traffic. Erosion control must be part of the planning process, and staff responsibility needs to be identified.

IMPLEMENTATION OF PARK PLANS

Considerable progress has been made in implementing the policies and recommendations of the Plan for Golden Gate Park (1979) and Golden Gate Park Forest Management Plan (1980). Of the five policies of Objective II of the Plan for Golden Gate Park (1979), three have been fully implemented and two have been partially implemented. Of the eight recommendations of the Forest Management Plan, all have been initiated.

A third document, Reforestation Practices and Procedures, Golden Gate Park (1980), described landscape design problems, tree removal and reforestation procedures. Although the management guidelines from this document were not implemented due to conflicting directions, the landscape assessment procedures and their mapping units were integrated into park planning.

PLAN FOR GOLDEN GATE PARK

Objective: Provide for the protection and renewal of the park landscape.

> *"A park . . . should be an agglomeration of hill and dale, meadow, lawn, wood and coppice, presenting a series of sylvan and pastoral views, calculated to banish all thoughts of urban objects, and lead the imagination to picture space beyond as a continued succession of rural scenes and incidents."*
>
> **William Hammond Hall**
> **November 30, 1873**

This section provides a detailed review of the status of implementation of the Plan for Golden Gate Park. The information is presented in the following format:

- The Policies and their Actions are repeated verbatim as they appeared in Objective II, 1979 Plan.
- Their status of implementation is indicated in *italics*.
- A brief discussion of potential issues for the master plan update is included at the end of each policy section.

POLICY A: Ensure that the essential design elements that give the Park its unique landscape character are retained and protected.

1. The major design feature of Golden Gate Park and the framework within which all Park activities occur is its pastoral landscape. The integrity of that basic design must be maintained, and, most important, remain unaltered.

2. The existing form of wooded areas and their relationship to meadow areas should be maintained. The size, the basic texture, and color of Park woods should not be significantly altered nor should the size of meadows be reduced by the introduction of additional trees.

3. It should be recognized that the park, by design intent, is basically evergreen. Large-scale introduction of deciduous or flowering trees in areas other than traditional horticultural gardens should be discouraged.

4. Park horticultural gardens and formally landscaped areas provide the contrast and picturesque qualities essential to complete the Park experience. The historic locations and traditional horticultural usage of these features should be maintained and protected from encroachment.

5. It should be recognized that, because the Park's unique landscape character is a wholly artificial creation, its care and maintenance is highly labor intensive. Sufficient numbers of qualified personnel must be retained to ensure the Park's continued preservation and maintenance.

6. To ensure the continuity of the Park's essential landscape elements, a position should be established within the Recreation and Park Department in the area of landscape architecture and urban forestry to coordinate and guide landscape plans and horticultural modifications within the Park.

> ***STATUS:*** *Policy A has been partially implemented. Concerns still exist over integrity and unity of park design, and sufficient personnel staffing. Conflict over the issue of deciduous versus evergreen plantings has also been identified and needs to be addressed.*

POLICY B: Develop a long-range plan for effective management of the Park's forested areas.

1. A forest management plan for Golden Gate Park should be based on the following objectives:
    a. Develop and maintain on a continuous basis a comprehensive and appropriately detailed inventory of all wooded areas.
    b. Develop and maintain, on a continuous basis, a program to implement long-term reforestation and horticultural maintenance.
    c. Develop appropriate wood-waste recycling and utilization programs.

2. The management plan should complement existing Park reforestation programs by focusing on:

a. Immediate rehabilitation of the Park's windbreaks.
b. Removal of hazardous, diseased and dying trees; replacement with appropriate tree species.
c. The replacement and maintenance of Park perimeter landscape screening.

3. Additional consideration should be given to aesthetics, wildlife habitat requirements, noise control and appropriate recreational use.

> ***STATUS:*** *Policy B has been fully implemented under the guidance of the Golden Gate Park Forest Management Plan (1980). This Forest Management Plan is due for revision to meet current issues and concerns.*

POLICY C: Develop new irrigation water supplies and improved water distribution and application systems.

1. Provide consistent water pressures and volumes.

2. Improve and maintain existing well system. Where feasible, restore inoperative wells.

3. The proposed Southwest Sewage Treatment Plant will generate large quantities of reclaimed waste water. This effluent, with additional treatment, should be used for parkland irrigation. Coordination between the Recreation and Park Department and other affected agencies would facilitate use of reclaimed water to irrigate Golden Gate Park, Lake Merced, Lincoln Park, the Great Highway, and the Golden Gate National Recreation Area

4. Convert meadow areas, play fields, and where feasible large scale ornamental plantings to automated irrigation systems.

> ***STATUS:*** *Policy C was partially implemented. Funding for irrigation and well improvements fell short of needs, but the 1992 park bond addressed this shortfall.*

POLICY D: Establish designated areas of the Park's cultivated landscape as "Naturalistic Parkland" to preserve and protect the pastoral character of the Park and to ensure retention of Park open space.

1. Areas designated as "Naturalistic Parkland" should include the Park's woodlands, scenic lakes, ponds, marshes, water-courses and wildlife habitats.

2. Recreational use of areas designated as "Naturalistic Parkland" should emphasize and encourage appreciation of the Park's pastoral qualities. Appropriate activities would include nature walks, bird-watching, photography and educational pursuits.

3. No structures or additional roadways other than those required for maintenance should be allowed within those areas designated as "Naturalistic Parkland." Where possible, existing roads should be removed.

> ***STATUS:*** *Policy D has been implemented, but serious growth in recreational pressures threaten these areas.*

POLICY E: Ensure that gifts accepted for placement in Golden Gate Park will contribute to the historic character of the Park and are compatible with the planted landscape.

1. Because the Park is essentially a completed landscape, additional features tendered to the Park should be carefully reviewed prior to acceptance to assure that they will not diminish the integrity of the basic design.

2. Creation of an endowment fund to allow prospective donors to contribute to the restoration and maintenance of horticultural features and historic monuments should have a high priority.

3. All gift proposals for Golden Gate Park should be in accordance with existing Recreation and Park Commission "Guidelines for Acceptance of Major Gifts" and the policies of the Plan for Golden Gate Park.

> ***STATUS:*** *Policy E has been implemented.*

RECOMMENDATIONS OF THE FOREST MANAGEMENT PLAN

The Golden Gate Park Forest Management Plan (1980) developed an eight-point program to reforest the park. These points covered program development, timing, priorities, hazard reduction, irrigation, maintenance, staffing and waste wood management. All elements of the program have been initiated, although an ongoing effort such as this requires constant monitoring, evaluation and revision to fine-tune further efforts. Specific concerns remain over items (7) and (8), staffing and wood waste management.

The eight recommendations are followed by comments on their initiation in *italics:*

1. A reforestation program should be initiated for the Park.

> ***STATUS:*** *The reforestation program was initiated upon completion of the Forest Management Plan. Under the direction of Jim Cooney, the Park's first forester, the Urban Forestry Division was established within the San Francisco Recreation and Park Department. The new division's primary goal was the reforestation of Golden Gate Park.*
>
> *The reforestation program has planted about 20,000 trees over 100 acres of Golden Gate Park.*

2. The program should involve planned areas which, over a 25-year period, renew the Park forest. It is suggested that 1,800 planting areas be involved.

> ***STATUS:*** *The reforestation program goal was to replace the forest in a 25-year period. Due to labor costs, landscape impacts and limited locations for planting, the program is now on a 50-year replacement program. This longer period will greatly facilitate institution of the desired long-term, uneven-age tree management program. The trade-off has been a more visible decline in the forest.*

3. Reforestation of a western windbreak should begin prior to other efforts. A barrier to protect planted trees from the wind will be required.

> ***STATUS:*** *Forest decline has been significant in the western part of the park. Over two-thirds of reforestation efforts have been established in the critical western windbreak areas by planting in areas where trees have already died or failed.*
>
> *High-use areas in the Park east of Crossover Drive have also suffered visible decline. Additional funding to meet reforestation and equipment demands of these high-use areas was approved by San Francisco voters in a 1992 bond measure.*

4. The program should include planned replacement of trees that present special problems of disease or growth habit and are located near buildings, over parking areas or high-use areas.

> ***STATUS:*** *When the urban forestry division was created, the arboriculture staff was increased to meet the removal and hazard reduction needs of Golden Gate Park. Since then, however, the staff was decreased 25 percent.*
>
> *Since older trees become greater potential hazards as time goes on, the removal and replacement programs must meet these demands.*
>
> *A system of assessing the landscape has been implemented to address site-specific horticultural problems and reforestation needs.*

5. Adequate irrigation methods should be designed and constructed prior to reforestation. Irrigation should include hand watering to produce deep-rooted trees.

> ***STATUS:*** *Irrigation pipes for reforestation of the Park were installed in 1981-82 using federal grants for Park improvement. Temporary new lines were extended into reforestation areas. Since these irrigation pipes were designed to be usefullfor only a few years to establish new seedlings, they now need replacement due to breakage or inadequate delivery of water pressure. New waterlines need to be permanent, to meet the long-term reforestation requirements.*

> *The drought also severely limited the ability of staff to deep-water reforestation sites cheaply.*

6. A program of care and maintenance of new trees should be initiated. New trees should be in excellent initial condition.

> ***STATUS:*** *Problems with new trees were identified and new nursery practices were instituted. Significant seedling health and out-planting successes were noted with the improved stock.*
>
> *The nursery has suffered severe budget cutbacks, so the reforestation staff assists in the nursery.*

7. Personnel and equipment will be needed for the program. A person with forestry, gardening, landscaping and management skills should be hired to coordinate and administer the reforestation program. Some additional staff and equipment will be required for tree planting, removal and care.

> ***STATUS:*** *The Recreation and Park Department has an urban forester with the responsibility and authority to manage all aspects of the Park forest.*
>
> *The reforestation and arboriculture staff was hired as recommended in the Forest Management Plan. Recent cutbacks in funding have reduced these crews, resulting in delays in meeting reforestation and tree maintenance goals.*

8. A wood use program should be developed to manage current and future waste wood. According to the cost/benefit analysis, a wood energy program would be the best alternative.

> ***STATUS:*** *Wood waste continues to be a serious problem in the Park. Several remedies have been tested such as sales of firewood and use of chips for mulching and composting. Current practices of creating landscape chips for mulch and compost is costly but desirable for erosion and horticultural purposes. Future solutions would be to look at selling wood waste as biomass to electric cogeneration plants.*

REFORESTATION PRACTICES AND PROCEDURES, GOLDEN GATE PARK (1980)

The manual, Reforestation Practices and Procedures, Golden Gate Park (1980), by Larry Seeman Associates, described landscape design guidelines, tree removal and reforestation procedures.

> *The landscape assessment procedures and their mapping units from this document were integrated into park planning. The ongoing landscape assessment provides a multidisciplinary review of landscape maintenance. This*

process has helped educate the horticultural staff as well as the planning staff on landscape design and preservation.

The forest management guidelines from this document are textbook examples of how urban forestry should be implemented. Unfortunately, Golden Gate Park is not a classic urban forest due to its harsh climate, droughty, nutrient-poor dune sand soils, and the fact that it was artificially developed using aggressive but short-lived trees. Desirable reforestation techniques such as interplanting and individual selection were extensivly tried prior to 1980 with no success. These textbook practices and procedures are only feasible in the most maintained sections of the park.

The Golden Gate Park Forest Management Plan (1980) continues to provide the necessary practices and procedural direction to continue the Park's reforestation program. Park research and reforestation tests continually prove that the existing species and group selection practices will preserve the landscape as designed by McLaren and Hall. Cost effective watering, thinning and fertilization practices are continually being updated by reforestation staff.

CURRENT CONDITIONS

More than a century ago, the 1,017 acres now occupied by Golden Gate Park were part of a vast area of windswept sand dunes. This substantially artificial park was initiated in 1870 by William Hammond Hall and completed under the guidance of John McLaren, Park Superintendent for 56 years.

Hall constructed an artificial dune and a windbreak fence along the ocean beach to moderate the unfavorable environment. Leguminous shrubs and dune grasses were used for soil stabilization, and windbreak plantings were established along this critical western edge of the park. Hall and McLaren improved the sandy soil by bringing acres of topsoil up from the peninsula and utilizing ample supplies of manure from the streets of San Francisco. They selected tree species which were fast growing and tolerant of salt-laden winds and droughty soils. Pine and cypress seed were brought from the Monterey Peninsula, European pine and cedar seed from the Mediterranean. Eucalyptus, acacias and tea tree seeds were introduced from Australia. By 1885, 155,900 trees and shrubs had been planted the entire length of the park.

Sustaining this great creation of green space in the face of nature's adversities requires ongoing maintenance and regeneration. Because of shifting maintenance and development priorities and the unique character of this urban forest, regeneration of the Park was not systematically undertaken for almost another century. Because new trees were not planted in wooded areas to offset the uniform aging of the forest, nearly all the trees in the forested section are between 85 and 115 years old. Since overmature trees are more susceptible to a variety of pests and diseases, windthrow and potentially hazardous weakening defects, a comprehensive vegetative management program was needed to preserve the future of the Park and its trees for generations to come.

REFORESTATION PROGRAM

The San Francisco Recreation and Park Department's urban forestry program was formally begun in 1979, through a cooperative agreement between Recreation and Park Department and the California Department of Forestry (CDF). The Forest Management Plan (1980) developed by CDF has served as a blueprint for the reforestation of Golden Gate Park.

The most significant finding of the 1980 inventory undertaken for the Forest Management Plan was that some 17 percent of the 33,000 trees in the Park were already dead or dying and in immediate need of replacement. Of the trees found in immediate distress, 87 percent were in the western section of the Park. Extremely hard-hit was the existing western windbreak of mature Monterey cypress *(Cupressus macrocarpa)* and Monterey pine *(Pinus radiata)*. The disintegration of the windbreak created the likelihood of a domino effect, allowing strong winds and salt air to whip into the Park to destroy newly exposed trees. Left unchecked, this destruction would proceed toward the eastern sections of the Park.

The major goal of the reforestation program is to replace the Park trees so as to create an uneven-age forest structure. With all age classes present in the future, relatively few overmature trees will require replacement at any one time. The goal for the first replacement cycle was set at 25-30 years.

OTHER FACTORS

As in all ecosystems, natural or designed, trees do not stand alone. The entire forest landscape is composed of plants and both resident and migratory animals. Human culture also influences the landscape. We attempt to follow design principles and have requirements for historic preservation, safety, mobility or other cultural purposes.

The needs of all the Park's inhabitants must be considered to maintain a balance between them. Soil and watering needs of plants must be addressed, as are habitat requirements of birds and other wildlife. And where humans control natural mechanisms such as fire, other methods for wood debris disposal must be found.

Native Forest

Although considered sterile dune when William Hammond Hall looked at the area now occupied by Golden Gate Park, it was not always thus. Botanists and geomorphologists of the 19th Century agreed that San Francisco once supported a unique native flora already almost extinct. Coast live oak *(Quercus agrifolia)*, dwarf horse chestnut *(Aesculus californica)*, California laurel *(Umbellularia californica)*, willow *(Salix lasiolepis)* and wax myrtle *(Myrica californica)* all were sighted in San Francisco, along with grasses, evergreen herbs, irises, lilies, wild violets and wild strawberries. Within a half-century of the arrival of Europeans, however, deforestation for fuel and timber and overgrazing by livestock destabilized vegetation patterns and led to the encroachment of sand which characterized the landscape familiar to Hall.

While there is no mandate to rehabilitate native plants for aesthetic or windbreak purposes, there is popular as well as scientific incentive to extend and reconstitute native plant communities. These plants are an excellent food source for a number of wildlife species, and, for some, rehabilitation meets an important aspect of the passive recreation purpose of the park. These native plant (SNRAMP) areas should be managed as special horticultural exhibits in the park forest.

A full discussion of indigenous plants will be found in Appendix A.

Wildlife

Golden Gate Park's Monterey pine, Monterey cypress and blue gum eucalyptus forest is home to various species of wildlife. These include reptiles, mammals, and seasonal and resident birds. Many of these animals are unique to the coast. Wildlife needs are best served by habitat diversity expressed as a mosaic of small areas of habitat type adjacent to each other, providing a mix of food sources, cover and open space: Maritime pine provides good food and shelter to migrating birds. Blue gum eucalyptus provides nectar and insects for wintering birds. Oaks are a particularly important resource for squirrels and birds in the park.

Control of "pest species" such as introduced birds (i.e., house sparrow) and feral cats is considered important to wildlife preservation. Removal of undesired exotic vegetation and the restoration of native flora in SNRAMP areas would encourage additional wildlife use.

A full discussion of wildlife conditions and needs will be found in Appendix B.

Wood Resources

Wood debris naturally increases as a forest ages and is a particular problem in an overmature stand of even-age trees such as Golden Gate Park contains. Although tree removal is currently restricted to dead or dying trees, implementation of the park's reforestation program has created an additional burden of wood debris volume. The historic use of in-house landfills for unwanted woody material is no longer viable and alternative disposal methods must be found.

Sale of waste wood to electric cogeneration plants and use of wood chips for erosion control and soil amendments appear to be the best options for handling wood debris at this time.

A full discussion of options for disposal of wood debris will be found in Appendix C.

INVENTORY

A new survey of park trees and vegetation has been undertaken by Stephen Smith in cooperation with the staff of the Recreation and Park Department. Analysis of the inventory will be performed by the California Department of Forestry. This inventory, 13 years after the 1980 Forest Management Plan, will look at growth, vigor, mortality, species variety and reforestation success. It is expected to be complete in summer of 1993.

THE 1979 SURVEY

In developing the original Forest Management Plan for Golden Gate Park, a detailed survey was conducted in 1979 to determine the health and vigor of the trees, identifying tree diseases and insect problems. Factors that may have led to problems such as aging, excessive soil drainage, and salt laden winds were assessed. Areas in need of reforestation efforts were specified. Also, the amount of wood residue that would result from the dead and declining trees of the Park was assessed.

To meet forest management objectives, a permanent survey system was developed that determined the growth rate and volume of wood in the Park, tree health and reforestation needs. The continuous survey was developed to accommodate future reassessment of the Park forest.

The continuous forest assessment is a management tool necessary to document changes in the age and condition of the forest. A second survey has been completed by the Park staff as of January 1993. This resurvey was conducted using the same plots that were established during the initial survey. The resurvey is used to determine the mortality rate of older trees, the current growth rate of trees, maintenance needs, safety, disease incidence and insect populations. This survey also assisted in noting where reforestation efforts were successful and where future work should be.

SUMMARY OF RESURVEY PROCEDURES

The 1,017 acres of the Park were gridded in five-chain squares and data was taken on circular one-fifth acre plots at designated intersections of grid lines in the forested areas.

The plots were established in 1979 with a metal stake as the central point and witnessed by two trees with metal numbered tags fastened just below ground level. Each plot center corresponded to a reference point such as light standard, fence or statue. These plots were relocated for the 1993 survey.

Data collected at each of the plots consisted of the slope and aspect of the terrain, soil type, percent crown cover and reforestation requirements. Individual tree data consisted of species, diameter, maintenance needs and any defects or diseases present. The tree's general condition was then determined using a vigor rating system.

SUMMARY OF ANALYSIS PROCESS

The forest survey was completed in January 1993. One hundred and forty-seven plots were inventoried, covering 30 acres of the 623.5 forested acres. A computer analysis of the collective data will be completed by the California Department of Forestry.

Information will be tabulated for each major tree species in the Park. The total number and volume of trees requiring replacement and those categorized in poor, dying or dead condition are to be determined. The volume and number of trees in fair, good and excellent condition are also to be calculated.

Species will be analyzed to determine their longevity in the Park environment. This will be accomplished by comparing the number of older trees from 1979 to 1993 to determine the rate of mortality. Age and density for the trees will be obtained on the basis of diameter, number of trees per acre and their vigor ratings.

In 1979 a reforestation code given to each plot was compared to the stand condition. Plots with high vigor would not be expected to need reforestation, whereas plots with low vigor would be expected to need reforestation. The reforestation code was also compared to the average crown cover. Plots needing reforestation were more likely to have less crown cover (less trees) than those not needing reforestation. A comparison of this information to the resurvey plot data after 13 years will help determine what forested areas should be selected in the future.

INITIAL RESURVEY ANALYSIS

The initial resurvey of Golden Gate Park's forests noted the continued need for a reforestation program in the Park. Although the resurvey data will not be fully analyzed until April 1993, a number of obvious points were noted.

Even with an aggressive campaign to remove trees in poor, dying or dead condition, the Park forest and understory is showing its age. Over 20 percent of the trees in the plots are in a state of decline. Other indications of age-related defects were a high incidence of rot, leaning trees and die-back. Landscape screens--walls of shrubs and trees designed to block out the urban surroundings--have innumerable holes in them.

Efforts by the Park staff to replant its forests have been very successful. An initial survey showed that the number of young trees found in the forested areas has greatly increased and most of the young trees are in good condition. This is a complete reverse of the 1979 findings. The process of reducing competition with older trees for sunlight, water and nutrients has been successful.

Aside from confirming that portions of the Park's forests are declining, the resurvey will help identify necessary locations for reforesting the Park. The initial data confirms that reforestation should continue to be concentrated in the west end of the Park, but that it is also needed in the other forest areas.

The initial resurvey data noted that the reforestation program is at a 50+ year renewal pace, although it should take place over 25 to 30 years as noted in the 1980 Forest Management Plan. Although the reforestation program uses these practices to provide the Park with an efficient method of reforestation, inadequate staff and money have restricted the success to limited areas of the park.

APPENDIX A: NATIVE FOREST

Golden Gate Park is and will continue to be largely the artificial creation of its designers; reforestation efforts will focus on restoring the Park to their original vision. However, development of the Significant Natural Resource Areas Management Plan (SNRAMP) by the San Francisco Park and Recreation Department has called public attention to the area's remaining historic natural resources. As part of SNRAMP, significant areas of indigenous flora in the Park will be identified, designated and inventoried, and standard management policies will be established for their protection.

PURPOSE

Botanists and geomorphologists agree that San Francisco once supported a unique native flora due to its geographic and climatic isolation, but many of the plants that once colonized and stabilized the dunes have long been lost along with their supporting ecology (wildlife). Because of their low value for firewood or fodder, only remnant oak forest thickets survived the arrival of Europeans. By the time the Park was planned, the area was considered a sterile wasteland.

The purpose of this section is to look at the Park's natural history and put it into current perspective.

VEGETATION PRIOR TO EUROPEAN SETTLEMENT

Trees were probably never a conspicuous feature in the Golden Gate Park landscape, but in the earliest days small trees of several kinds were found on the hills and summits nearby.

Archibald Menzies, visiting San Francisco with the Vancouver Expedition in 1792, wrote of the scrubby oaks (*Quercus agrifolia*) and dwarf horse chestnuts (*Aesculus californica*) scattered on slopes above their northeast anchorage (Menzies, published 1924). Menzies also noted "tufts of trees" on the ridges near Mission Dolores, but did not record their identity.

Dr. H.H. Behr (1891), one of the first to completely inventory the San Francisco flora, recounts that there was a fringe of California laurel (*Umbellularia californica*) along the northern shoreline and that an unknown conifer grew on Lone Mountain.

The only remaining native tree species growing at present and numerous enough to form a woodland community is the coast live oak (*Quercus agrifolia*). This species forms small groves in the eastern part of Golden Gate Park. In wet places and around the strands of ponds and lakes, willows (*Salix lasiolepis*) and wax myrtles (*Myrica californica*) still exist but do not form a woodland.

CLIMATIC CONDITIONS

Climatic conditions dictated which woodland tree species would survive at Golden Gate Park. The oceanic influence on the Park forest is of special significance during the summer months, since summer dryness is the most important factor in local plant distribution. All the plants in the Bay region are adapted to the moderate, wet winter months; but only some of them can survive the long, warm, dry summers in areas shielded by topography from the cool ocean air and summer fog. On the other hand, frequent and persistent summer fogs in the immediate coastal areas are well timed to afford shade, lower temperatures and higher humidity to plants in a season that would otherwise be most difficult to survive.

Other more restricted influences cause environmental differences and consequent irregularities which make Golden Gate Park area unique.

EXPOSURE OF SLOPE

At any time during the year the greatest amount of sunlight per area is received by southward-facing slopes. Other conditions being the same, this amount of sunlight will be significantly greater than the amount of sunlight received by an equal area of level ground. The difference between the amount of sunlight received by northward-facing slopes and southward-facing slopes is even greater. The northward-facing slopes and southward-facing slopes also differ considerably in soil temperature, soil moisture and atmospheric temperature near the ground.

In addition, there is a smaller, though still significant, variation in ground temperatures between eastward-facing slopes and westward-facing slopes. The two slopes receive an equal amount of sunlight, but several factors lessen the heat absorbed by the ground on the eastward-facing slopes.

SUMMER FOG

In the Bay region summer fogs are common in the morning hours when the eastward-facing slopes would otherwise be receiving their maximum intensity of sunlight. By afternoon, the fog has usually dissipated and the westward-facing slopes receive the full light of the afternoon sun. Moreover, even if there is no fog, some of the energy of the morning sun is spent in evaporating the nightly accumulation of moisture. By afternoon this moisture is mostly evaporated and more heat is available for absorption by the ground.

Variations in soil moisture, soil temperature and the contiguous atmosphere affect the vegetation of differently facing slopes; that is, slopes that face toward the south and southwest tend toward chaparral and grassland; slopes that face toward the north and northeast tend toward more woodlands.

EXPOSURE TO WIND

The specific effects of wind on the plants can be mechanical or physiological. (Richardson, 1943). Fairly continuous and often high wind movement significantly affects the distribution of Golden Gate Park's vegetation. The region immediately along the ocean coast is most affected by relatively high and constant wind. Wind-swept slopes facing south and the ocean are dominated by grasses and prostrate shrubs, and trees are found only in the sheltered valleys. Some trees, notably *Umbellularia californica*, can withstand high winds by assuming a prostrate form.

TOPOGRAPHY

According to W.S. Cooper of the Geological Society of America, topography is responsible for wind conditions in the Park. The gap in the mountain barrier at Golden Gate, which leads to San Francisco Bay, allows free air movement to the interior lowlands. The summer gradient in barometric pressure from high over the ocean to low over the interior is uninterrupted. Topographic control is so effective that the normal coastal wind pattern is significantly altered and the usual north-northwest quadrant of effective winds is rotated 90 degrees southward to west-southwest.

WIND DIRECTION

Dominant offshore winds in winter are low in mean velocity. Strictly onshore winds are confined to the southwest and west. For the whole year they comprise an average of 65.4 percent of all occurrences; for the eight-month period March through October, 90 percent. In July and August they are usually the only ones recorded (Cooper 1967).

The wind-caused movement of the sand dunes also affect established plant communities. W.P. Blake, one of the first to describe these dunes in 1857 stated that

> ... on the Pacific side of the San Francisco peninsula there is an extensive sand-beach, reaching for several miles north and south, and a long distance inland. A wide area is thus covered by loose, dry, sand, and it has the aspect and character of a desert. This sand is moved about by the wind and is constantly progressing inland, being thrown into wave-like hills, which move forward and bury shrubs and trees that lie in their path. The extensive formation of blown sand within the city limits has undoubtedly been accumulated by the action of the sea winds upon the sand of the beach, it having been transported from one side of the peninsula to the other.

> Most of the hills in the city and its vicinity, where they were partly sheltered from the wind, are, or were, covered with a thick growth of dwarf trees and shrubs, which prevented the wind from acting upon their surfaces and removing the sand...(this happens) whenever the vegetation is removed, or a cutting is made, and the wind is allowed to act upon the surface, or to strike a hill in a new direction. The motion of the sand is rapid, and a large hill is soon carried away and piles up in a protected place where the sand remains secure from further violent action. (Cooper, 1967)

NATIVE VEGETATION DISTRIBUTION

Ocean climatic influences combined with wind, topography and sand to create a complex mosaic of plant communities. Evergreen woodlands, riparian thickets, chaparral, coastal prairies and dune grasslands were definitely recognizable, separate, botanical formations, but at Golden Gate Park, many of them were clustered within a small area.

Eastward of the ocean and the sand dunes was an extensive treeless area, and, according to W.C. Clarke's "Vegetation Cover of San Francisco Bay Region, Spanish Period" (1959),

> ... the hills and valleys of San Francisco were covered with a disjointed pattern of marsh vegetation, grass, low live oaks, occasional other trees, chaparral, and a sparse scrubby growth. It is impossible to determine from the Spanish accounts the exact distribution of these various types of vegetation. The later non-Spanish accounts give specific locations and even provide lists of species for some of the types of vegetation, but it can not be assumed that the vegetation remained unchanged throughout the Spanish and Mexican periods.

Using extracts from published diaries of the early regional explorers, Clarke summarized vegetation communities in the pre-European situation:

> The Anza expedition in 1776 described the area near Mountain Lake and the high tableland that extends northward to Fort Point as treeless and covered with a growth of grass, yerba buena (*Micromeria chamissonis*, a trailing perennial, evergreen herb), lilies (*Lillium spp., Iris spp.*), and wild violets (probably *Viola adunca*). The soil of this area is partly dune sand and partly Olympic clay loam derived from serpentine, both of which were soils likely to be treeless.

Not far to the east of Mountain Lake there was an abundant supply of firewood and live oak, which probably grew on Altamont clay loam, a strip of which begins a little to the northeast of Mountain Lake and continues eastward across Pacific Heights, Nob Hill, Russian Hill and Telegraph Hill. During the Spanish period the largest oaks and thickest chaparral of San Francisco probably grew on these hills, whereas the dune-sand areas to the north and south were largely covered with grass and other herbs. According to Behr (1891), "...the scrub of *Quercus agrifolia* (coast live oak) now to be seen in Golden Gate Park fairly represents the oak vegetation." The live oaks were not evenly distributed on the hills, but formed groves or clusters, which were mostly on north-facing slopes and in the arroyos.

Historical Accounts

Near Mountain Lake. In H.E. Bolton's (1930) account of Anza's California expeditions, Father Font, a priest accompanying the expedition, described the area near Mountain Lake:

> This place and its vicinity has abundant pasturage, plenty of firewood, and fine water, all good advantages for establishing here the presidio (or fort)... It lacks only timber, for there is not a tree on all those hills, though the oaks and other trees along the road are not very far away...Here and near the lake there are yerba buena and so many lilies that I had them almost inside my tent.

Anza agreed with Font's opinion of the Mountain Lake area. There was

> ...much firewood and good pasturage, sufficient and even in superabundance for pasturing cattle. But along with these good qualities one must mention the lack of timber, for in the district examined there is none even for barracks. (Bolton, 1930)

Between Mountain Lake and Fort Point. Font reports that the party "...entered upon a mesa that was very green and flower-covered, with an abundance of wild violets. The mesa is very open, of considerable extent, and level, sloping a little toward the harbor" (Bolton, 1930).

Northeastern San Francisco. From the hills of San Francisco, Font went down to the beach of the Marina and, from there,

> ...continued along a plain in an opening made by some hills, all of very good land and well grown with grass and other herbs. In the middle of it there is a small lake like a fountain or spring of fresh water with tule, of which we saw three rafts made there. If a ditch were made for it this water would run to the beach of the estuary, and then all the plain, which is not small, would become very good for planting crops. It appears that this water is permanent because at the foot of the hills in their canyons it is very green and shady, with plentiful small trees. We climbed another hill and then entered a very thick grove of scrubby live oak and other small trees and brush which continues for a considerable stretch over the hills along the shore of the estuary. (Bolton, 1930)

The lake he speaks of was situated near the present intersection of Octavia and Greenwich streets. The hill he climbed was probably Nob Hill. Anza's account of the same area contains some different details:

> Very soon after leaving the vicinity of our camp (Mountain Lake) I began to find running water, an infinite supply of firewood, timber for barracks, mostly of oak, both green and dry and of good thickness, but bent toward the ground because of the constant northwest winds on this coast. (Bolton, 1930)

Northeastern San Francisco and Mission Dolores. On their return journey to Monterey, the members of the Anza expedition left the camp at Mountain Lake, marched eastward, then southward, probably between Pacific Heights and Nob Hill, to the future site of Mission Dolores. Font reported

> ... passing through wooded hills and over flats with good land, in which we encountered two lagoons and some springs of good water, with plentiful grass, fennel, and other useful herbs, we arrived at a beautiful arroyo which, because it was Friday of Sorrows, we called the Arroyo de Dolores. On its banks we found much and very fragrant manzanita and other plants, and many wild violets. (Bolton, 1930)

Circa 1792

Yerba Buena Cove. Archibald Menzies, the official naturalist in the party of the noted English explorer of the west coast, George Vancouver, reports that the shore around Yerba Buena Cove (east of Fort Point) was in many places covered with bushes "of a stunted scrubby appearance and not very numerous in variety." These thickets were largely composed of *Quercus agrifolia*, but *Photinia arbutifolia*, *Aesculus californica*, *Ceanothus thyrsiflorus*, *Baccharis pilularis*, *Ericameria ericoides*, *Salix lasiolepis*, *S. lasiandra*, and *Lonicera involucrata* were also present (Menzies, 1924).

East of Fort Point: Menzies noted that the shore of the bay just east of Fort Point and north of San Francisco was lined by a low tract of marshy ground. Firewood was difficult to acquire as there was only scrubby brush wood on the side of an adjacent hill (Menzies, 1924). This maybe the first noted observation of European impact on the vegetation. While the fort was built of the large oaks, the smaller wood was used for fuel wood for both the settlement and passing ships.

Vancouver reports that the marshy ground was a seawater lagoon between the beach and the mainland. The brush was small bushy *Quercus agrifolia*. Fresh water was secured from a low space behind the beach covered with a spiny grass and flooded with rain. When they returned the following October, this area was quite dry and the hills surrounding San Francisco appeared barren (Vancouver, 1953).

Between the Presidio and Mission Dolores. Vancouver found that the ride between the two settlements

> ...was rendered unpleasant by the soil being very loose and sandy, and by the road being much incommoded with low groveling bushes...The barren sandy country through which we had passed seemed to make a natural division between the lands of the mission and those of the Presidio, and extends from the shores of the port to the foot of a ridge of mountains which border the exterior coast and appear to stretch in a line parallel to it. The verdure of the plain (about the mission) continued to a considerable height up the sides of these hills; the summits of which, though still composed of rugged rocks, produced a few trees. (Vancouver, 1953)

Circa 1816

Near the Presidio. D. Chamisso, the naturalist of the Russian Kotzebue expedition, remarks that on the naked plain in front of the Presidio there was a solitary oak growing among low bushes. Near the Presidio he collected a specimen of *Potentilla anserina*, a plant characteristic of marshy or springy places (Mehr, 1932).

San Francisco. Speaking of the San Francisco area in general, Chamisso remarks on the beautiful irises (*Schertililien*) and other flowers that adorn the hills and alleys in spring. *Quercus agrifolia* is noted as the largest and most common tree. Also noted are *Ceanothus, Diplacus, Oenothera, Soldidago, Aster, Rhamnus, Salix* and *Aesculus* (Mehr, 1932).

The plants collected by Chamisso in the vicinity of San Francisco included

Erysimum asperum
Silene verecunda
Hydrocotyle prolifera
Eschscholtzia californica
Fragaria chilensis
Potentilla anserina
Rosa californica
Triglochin maritima
Veronica americana
Diplacus aurantiacus
Cornus californica
Ericameria ericoides
Myrica californica
Salix lasiolepis
Ribes malvaceum
Frankenia grandifolia
Plantago maritima
Hydrocotyle ranuculoides
Rubus vitifolius
Fragaria californica
Potentilla kelloggii
Viola adunca
Photinia arbutifolia
Scrophularia californica
Erigonum latiofolium
Micromeria chamissonis
Artemisia californica
Quercus agrifolia
Corylus rostrata var. californica

Circa 1820

At this time, the following trees had been described in the Golden Gate Park area by earlier explorers:

Arbutus menziesii
Myrica californica
Umbellularia californica
Aesculus californica
Salix lasiolepis
Heteromeles californica
Prunus ilicifolica
Quercus agrifolia
Salix lasiandra

It can therefore be surmised from the diaries of the early explorers and settlers that before the coming of the European to the San Francisco peninsula, the area now constituting Golden Gate Park was not completely denuded of tree cover as it was for the first American arrivals and as it appears in the earliest sketches and photographs.

During the first 50 years of Spanish occupation, the direct activities of the inhabitants affected only small areas. Agriculture, including grazing, was limited to the immediate vicinity of the Mission, and Spanish inhabitants did not travel far beyond the established routes between settlements. Until 1835, when Yerba Buena was first occupied, the only settlements in San Francisco were the Mission and the Presidio. In their vicinity some trees and brush were cut down for firewood; available grasslands were grazed; and live oaks were used to construct buildings, palisades, and furniture.

The oak trees, shrubs, grasses and brush that furnished acorns, grains, and berries to the Indians quickly disappeared under Spanish and then Mexican rule to meet the demands for timber and firewood. Herds of sheep, goats, cattle, horses and mules were allowed to graze unhindered and uncontrolled, reducing the lush meadows to barren, rocky sand patches and sand dunes. The dunes of Golden Gate Park were probably stable grasslands and very desirable for the local livestock.

Circa 1840

The most widespread change in the vegetation during the Mexican period was a decrease in grass and a probable increase in brush--the result of years of constant grazing by livestock. Chaparral is mentioned in the first Spanish reports of eastern San Francisco, but there is also frequent mention of abundant and good pasture. The chaparral species mentioned in later accounts were probably present in limited amount when the Spanish first arrived, whereas accounts from the 1840s suggest decimated pastures and a colonizing growth of chaparral. The Mexican cattle industry, controlled by the Californios, was at its peak during this period. The dunes that had been stabilized by vegetation started moving.

Angel Island, called Wood Island for many years, was once covered by fine oak trees, but these were quickly cut after 1840 to supply whaling vessels that rendezvoused at Richardson's Bay and to furnish building materials and firewood for military garrisons. (Lieutenant Colonel E. K. Stewart, 1971)

Circa 1848

By the time the United States controlled San Francisco, trees were few and primarily confined to the hollows and drainages where they were away from development, sheltered from the nearly constant wind, and where soil moisture was available. According to Lieutenant Colonel E. K. Stewart (1971), the U.S. Army officers and troops of the Presidio, most of whom were from the tree-covered eastern United States, found the site a barren, bleak, windswept place.

THE SIGNIFICANT NATURAL RESOURCE AREA MANAGEMENT PLAN (SNRAMP)

Recognizing that public awareness and appreciation for the extent and historicity of Golden Gate Park's extraordinary biological diversity has grown rapidly in the past decade, the San Francisco Recreation and Park Department has initiated a plan to identify the remaining natural resources and offer them protection and enhancement for generations to come.

In support of this are general policies and management actions proposed by the Recreation and Park Department and public task force to preserve and protect valuable native resources in park areas throughout San Francisco. Implementation of these policies is vital to the protection of native plant resources in identified areas. They include:

- Maintain and promote indigenous plant species in designated SNRAMP areas;
- Reforest and replant SNRAMP areas to maintain diversity of original tree and plant communities;
- Propagate native plants using seed collected from the specific site to ensure the survival of identified genetic strains of native plant species;
- Provide fire breaks and maximize indigenous vegetation with low flammability and low fuel volume in high fire hazard areas;
- Remove exotic plants which adversely affect indigenous growth or present possible hazard in SNRAMP areas;
- Plant indigenous vegetation where appropriate as ground cover to control erosion on bare soils and steep slopes;
- Enhance native vegetation to protect riparian areas;
- Preserve indigenous vegetation for wild life habitat; and
- Protect vegetation listed as rare, threatened, endangered or of special concern.

Native Oak

Indigenous native oak woodland is a significant natural resource and should be managed accordingly. Native oak woodland occupies large sections of the eastern half of the Park including the North Ridge, Coon Hollow, Alvord Lake, Hippie Hill (north slope), Quarry Lake, slopes south and west of Children's Playground, Whisky Hill and Strawberry Hill.

Under SNRAMP management the park would:

- Develop and maintain on a permanent basis a comprehensive and appropriately detailed inventory of all oaks and toyons within the native oak woodland;
- Develop an ongoing program to remove exotic, invasive weeds (e.g. German and English ivy and cotonester) from the oak woodland; and
- Maintain a population of oak seedlings by using the Park nursery. Where feasible, all native species planted within the Park are to come from local genetic stock to preserve its gene pool.

The management of these areas should also complement existing park reforestation programs by diversifying understory species with plantings of indigenous trees such as oak, buckeye, madrone, laurel and toyon. This will allow for further protection of the unique gene pool of the remaining native plants in both Golden Gate Park and San Francisco. Native species management will require the expertise of a qualified botanist or horticulturalist to maintain genetic purity in the forest.

Table I notes native trees and shrubs that can be used in the western wildscape to complement the ongoing reforestation program. These native forests and park plantings will greatly increase wildlife which, in turn, will increase passive recreational activities such as bird watching and viewing the landscape.

CONCLUSION

By the time William Hammond Hall looked at the area now occupied by Golden Gate Park, it was considered a windswept wasteland by generations of San Franciscans. However, this was not the picture described by earlier explorers.

The coastal location and climatic conditions of this area set it apart from any other ecosystem. Although today only very modest examples of the vegetation fostered by this rare environment remain in the Park, the preservation, recovery and reintroduction of the original perspective is possible.

The native plants also support considerable wildlife, which makes the Golden Gate Park "wildscape" a working, sustainable ecology. Aside from mandates supported by safety and aesthetics to maintain existing native plants, there is popular as well as scientific incentive to extend and reconstitute native plant communities. For some, this rehabilitation meets an important aspect of the original passive recreation needs of the park.

APPENDIX B: WILDLIFE

Golden Gate Park's Monterey pine, Monterey cypress and eucalyptus forest is home to various species of wildlife, including reptiles, mammals, and both resident and seasonal birds. Many of the animals are unique to the coast and depend upon the pine, the cypress, the eucalyptus and associated shrubs for the food and cover which is their habitat.

GOLDEN GATE PARK WILDLIFE

Wildlife is an essential aspect of the total ecological picture of the Park. During the course of surveying the Golden Gate Park forest, many different species of wildlife were observed. Both species known to live in the Park and species presumed to live there are included in this document.

Digest of Wildlife at Golden Gate Park

Common Name	**Scientific Name**
Western gray squirrel	*Sciurus griseus*
Botta's pocket gopher	*Thomomys bottae*
Wood rat	*Neotoma* spp.
Rat	*Rattus norvegicus*
Gopher snake	*Pituophis cantenifer*
Garter snake	*Thamnophis* spp.
California salamander	*Taricha* spp.
Alligator lizard	*Gerrhonotus* spp.
Mouse	Family Cricetidae
Black-tailed jackrabbit	*Lepus californicus*
Rabbits	*Sylvilagus* spp.
Raccoon	*Procyon lotor*
Opossum	*Didelphis virginianna*
Striped skunk	*Mephitis mephitis*
Voles	*Microtus* spp.
Bats	Order Chiroptera
King snake	*Lampropeltis* spp.

Western toad	*Bufo boreas*
Monarch butterfly	*Danaus plexippus*

WILDLIFE HABITAT

Unquestionably, Golden Gate Park wildlife depend upon the Park forest habitat for food, water, cover and open space. The Park is divided into two parts--the developed area east of Crossover Drive and the less well developed area west of it. Generally speaking, the western "wildscape" provides the best wildlife habitat, though there are many fine spots in the eastern part of the park.

The specific needs of individual wildlife species are best served by habitat diversity, that is, a mosaic of small areas of one type of habitat that serves part of a species' needs adjacent to another type of habitat serving other requirements of that species. A good example would be a small clearing with abundant browse for rabbits surrounded by open forest which provides cover for their protection. Generally the greater the diversity of vegetation in terms of composition and age class, the greater the diversity of wildlife species.

Table II gives examples of habitat requirements of some species found in the Park.

Food

The Golden Gate Park forest supports a diverse selection of food-providing plants. Live oaks and pines, distributed throughout the forest, provide both browse and mast (a compound of edible material found on the forest floor). The few shrubs that exist in the understory also provide browse and fruit. Each species of wildlife must find specific foods in the habitat because each species usually will eat only certain foods regardless of the availability of other food sources. Hummingbirds and warblers, for instance, depend on eucalyptus for food. The quantity and quality of specific foods are essential to the quality of habitat.

Management of the ground cover, forest litter and snags will have considerable effect on the kind of food available and thus carries implications for the local animal and bird populations. The development of "edge type" forest and the prevention of further forest fragmentation promises an increase in food sources for all wildlife at the Park.

Water

Water is an equally vital component for high quality habitat. Good sources of water at Golden Gate Park come from man-made ponds, including the Chain of Lakes, streams, dew, broken pipes, and succulent vegetation. Fog drip among the pines and cypress also is an important source of water.

Cover

Forest cover serves several purposes. Most wildlife need cover for protection while feeding, sleeping, breeding, roosting, nesting and traveling. Cover quality is usually judged by its relative density or openness as required by a particular species.

Cover quality at Golden Gate Park is fairly diverse yet limited in quantity. The pine forest structure varies from area to area, providing a mosaic of cover density. Some of the forest contains an oak and shrub understory which provides an additional layer of cover beneath the pine overstory. Pine snags and dead-and-down trees which provide dwelling sites for birds, reptiles and mammals recently have been established and are populated.

Careful management of ground cover, forest litter and snags will aid in attracting suitable populations of wildlife. Winter wrens will take advantage of redwood slash deposited in gullies; owls like to nest in eucalyptus. Discreet brush piles left by gardeners provide temporary shelter for small rodents and other animals.

Open Space

The arrangement of cover is also important. The ideal horizontal arrangement provides a mix of open space and adjacent cover with varying degrees of density. Vertical arrangement of cover involves a diversity in the layering effect of plants and their canopies such as pine overstory with shrub understory.

A mosaic of forested and open grassland areas provides high edge diversity and is most important in wildlife habitat. Intermixed patches of sparse cover are more beneficial to wildlife than extensive homogeneous blocks of vegetation. High edge diversity generally translates into high species diversity and animal population numbers. The implementation of new forest planting areas and the establishment of a native understory will meet this need.

As noted earlier, habitat quality has suffered in areas where there is significantly less understory, vegetation and wildlife environment. Other areas will benefit from a reduction in feral animals.

Other problems facing the park affect wildlife. Water seeps from many of the lakes almost as fast as it can be pumped into them. Bulrushes and other pond weeds have formed marshes in the North and Middle Lakes. In the near future their continued spread should be checked.

Shrub thickets are being thinned to prevent homeless encampments or otherwise inappropriate usage, thus, inadvertently, reducing wildlife habitat.

Domestic Animal Competition

Pets such as domestic cats are natural hunters. When allowed to run free in a public area, they quickly take over all habitat, drive out less aggressive wildlife and compete with native predators for food. A study of feral cats at Asilomar State Conference Ground (Monterey Peninsula) demonstrated their significant effect on song bird populations. When the SPCA and the City of Pacific Grove developed a program to capture and remove the cats, the number of ground-feeding and nesting birds increased 10-fold within six months.

The feral cat population in Golden Gate Park has reduced other animal and reptile populations to a minimum. This serious problem is exacerbated by well-intentioned neighbors and visitors who provide food and other support to the former pets.

An interim evaluation of the Park forest shows that there is realistic opportunity of habitat improvement for birds and other animals. However, the feral cat population must be eliminated prior to undertaking improvement activities. A more detailed habitat assessment should be made after the feral population is under control.

BIRD HABITAT

Habitat for birds must provide adequate food, singing and lookout posts, protective cover, nest sites, nesting material, and roosts. Good management practices in the Golden Gate Park forest will insure a habitat which supports the maintenance of healthy, diverse flocks of birds.

The San Francisco peninsula has long been regarded as an exceptional bird-watching area, providing visitors from around the world with a remarkable diversity of bird life. Pelagic, rocky shore, pine forest, oak woodland and small freshwater pond habitats can be reached within a few minutes' drive from any point in the Park.

In many areas the Park is covered with an extensive forest of Monterey pine and cypress. A few pockets of coast live oak are found inland. Although Park design and age has removed or fragmented much of this forest in the eastern portion, the western coastal forest is still largely unbroken.

It stands to reason that such a unique forest would also harbor a unique assembly of birds. Stellar's jays and pygmy nuthatches of the pine forest regularly rub elbows with scrub jays, more typical of oak woodland. Equally unique is the coastal edge of this forest, where windswept clumps of pine and cypress are renowned by birders for their ability to attract fall "vagrants" -- migrant birds which have strayed from their normal migratory route.

The unique "edge" zone between woodland and meadow is treated as a specialized habitat. Such zones, called "ecotones," have long been thought by wildlife ecologists to harbor a greater diversity of fauna than their component habitat types.

As it happens, Golden Gate Park sits astride both elements--pine forest and forest edge types, further complicated by the coastal sand dune vegetation of the San Francisco Bay headlands. As urban development continues to consume remnants of these natural habitats (allowing pigeons to replace pygmy nuthatches in the process), the preservation of what remains of the historic ecology at Golden Gate Park becomes even more critical.

Research indicates that woodlands with a diverse structure have a greater diversity in bird species than uniform, even-age woodlands (MacArthur and MacArthur, 1961). Variety in height and density of vegetation allows a wider range of possible nest sites. In such woodlands, food sources also are likely to vary, appealing to more kinds of birds.

Raptor Corridor

The San Francisco peninsula is located along an important migratory route for raptors flying from as far north as Washington State to as far south as Baja, Mexico. In fact, most biologists consider Golden Gate Park and the Presidio of San Francisco as "habitat islands" or "habitat traps." Fall migration takes place in September and October. Competition with feral cats for food is especially critical to raptors.

Dune-Woodland Edge

At Golden Gate Park, structural diversity in vegetation is probably greatest where the dune and woodland habitats intermingle. In this "edge" zone an abundance and diversity of insects provide excellent forage for flocks of ground-feeding and fly-catching birds. Brewer's blackbird, scrub jay, American crow, white-crowned sparrow, mourning dove and house finch are regular late summer users. The white-crowned sparrow is a coastal breeder whose range in San Francisco County is generally limited to within one mile of the coast. The Academy of Sciences has documented distinct populations within Golden Gate Park.

Expected winter users of the edge zone include yellow-rumped warbler, black and Say's phoebe, and mixed flocks of sparrows--white-crowned, golden-crowned, and possibly fox, song, and Lincoln. Bushtit flocks may also venture into this zone, though not far from adequate cover.

Resources in this edge habitat may also be a valuable commodity for migrant songbirds. Unexpected sightings during September included chestnut-sided warbler, willow flycatcher, and clay-colored sparrow, all rare coastal migrants. The tropical kingbird has been recorded in the past, and a scissors-tailed flycatcher was noted down the beach a few years ago. Special effort should be made to preserve this unique "edge" zone.

Forest Fragmentation

Open woodland habitat is favored by many species, including woodpeckers and pygmy nuthatch, two of the more common Park residents. In fact, woodland with occasional scattered openings can increase species diversity by providing more varied resources where planted shrubs and small trees grow into the openings. On the other hand, too many openings, as happens when forests are cleared in urban areas, can lead to forest fragmentation and other undesirable consequences.

It is useful to know that in the eastern United States, the decline of eastern songbirds has been at least partially attributed to the creation of forest "islands" followed by subsequent invasion of disturbed habitats by less desirable species, like brown-headed cowbirds, European starlings, and house sparrows (Ehrlich, Dobkin, and Wheye, 1988). It is possible that in the Golden Gate Park area, Brewer's blackbird, American crow, and house finch should be added to the list. Although these are native species, their abundance and distribution have greatly benefited from urbanization (Davis and Baldridge, 1980).

Bird Population Assessment

Dan Murphy of the Audubon Society conducted a scientific assessment of bird life at Golden Gate Park for this report. Table I summarizes his findings.

- Forty species are year-round residents, five are summer residents, and 21 are winter residents. Of particular interest is the seemingly low inventory of summer residents, at least in terms of diversity, although future observations may add species to this list (e.g., orange-crowned warbler). Certainly birds, typified by large mixed flocks of warblers, sparrows and other songbirds, seem more abundant on the peninsula in winter.

- Each of the 15 species listed as confirmed exhibited actual physical evidence of nesting on the grounds, such as nest-building behavior, a nest with young or eggs, or recently fledged young.

- The breeding species also exhibited nesting behaviors, such as pair-bonding, courtship or territorial displays

SPECIFIC GOLDEN GATE PARK BIRD HABITATS

Stanyon Street to Crossover Drive

The Fuchsia Garden provides excellent habitat for Allen's hummingbird in spring and summer. Anna's hummingbird is present all year. Sparrows, finches, and scrub jays are permanent residents as well. There are records of migrant birds uncommon to the city in the oak grove east of the Fuchsia Garden.

The Rhododendron Dell has been known to attract a variety of vagrant and migrant birds in the fall. *Empidonax* flycatchers pass through regularly in the fall as do olive-sided flycatchers and western wood peewees. The pigeons in this area are not all rock doves; a large flock of band-tailed pigeons can frequently be seen in the Monterey pines and cypress over the rhododendrons.

Strybing Arboretum

Strybing Arboretum is by far the most divergent community in the park. From its beginning under the direction of John McLaren and Eric Walther in 1937, the Arboretum not only housed an excellent botanical exhibit, but has offered excellent birding as well. The pond across from the Japanese Tea Garden generally has an interesting flock of ducks, geese and swan, many of which are exotics. The Arboretum has the last large population of California quail in Golden Gate Park. Rufus-sided towhees seem to favor the the area as well. Flocks of chickadees, bushtits, kinglets and hermit and Townsend's warblers may be found there also.

Stow Lake

Stow Lake is the most widely used lake in the park. Strawberry Hill, the island in the middle, is accessible by two bridges.

Ring-necked ducks may be seen here in winter. A large flock of Brewer's blackbirds inhabits the small island near this area. The eucalyptus trees have fall migrants such as western tanagers and various warblers. A Tennessee warbler was sighted here in January 1987. The lake at the Japanese Tea Garden attracts mallards, American widgeons, lesser scaups and ruddy ducks. A tufted duck wintered in this area in 1972. The belted kingfisher, scrub jay and common flicker are also found in the area.

During the fall, winter and spring Strawberry Hill is home to a large number of sparrows and juncos. Allen's and Anna's hummingbirds reside on the island and scrub jays can usually be found here. During the fall, migrants seem to be attracted to the island. There have been recent sightings of acorn woodpeckers and other species rare on the coast, but common on the island.

Adjacent to Stow Lake is the Pioneer Log Cabin, situated on the edge of a meadow with a nice picnic area and excellent bird habitat of fruit- and berry-bearing plants.

The deciduous trees in this horticultural exhibit change with the seasons, and this is one of the most visually attractive locations in the park. Migrants such as western tanager, Wilson's and yellow warbler, and western flycatcher, various vagrants such as American redstart, blackpoll warbler and bay-breasted warbler have been seen here.

The Western "Wildscape"

The Park west of Crossover Drive is less formally designed and has less specialized horticultural features than the high-use eastern section. Built upon sand dunes, it is appropriately referred to as a naturalistic parkland or "wildscape" and lends itself to more leisurely walks and bird-watching experiences than the previously described areas.

Elk Glen Lake

Elk Glen Lake is located at King and 25th avenues. European widgeons favor this site; one has wintered here for several years. Wood ducks also seem to favor this lake. The lake's edge offers little vegetation, but the area is good for finches and sparrows, including the locally unusual Lincoln's sparrow. The trees usually have a flock of chestnut-backed chickadees and pygmy nuthatches.

Mallard Lake

Mallard Lake, a duck feeding pond, is on the south side of South Drive between 25th Avenue and Sunset Boulevard. A number of mallards, American widgeons, coots and gulls are present from early fall until mid-spring. Ring-necked ducks, lesser scaup and an occasional common golden-eye winter here. Land birds can be found around the back side of the lake. They may include black phoebe, red-breasted sapsucker and red crossbill.

Metson Lake

Wood ducks are regularly sighted at Metson Lake. They may be seen here throughout the year, although they are much less frequent during the summer. Mew gulls and a variety of ducks including northern shoveler are usually present during the fall, winter and spring. The south side of the lake has hermit and varied thrush, pygmy nuthatch and woodpeckers. The valley south of the lake once had California quail, sparrows and other species before feral cats became too numerous.

Chain of Lakes

The Chain of Lakes transepts the park between 41st Avenue and Lincoln Way and 43rd Avenue and Fulton Street. These three lakes provide one of the best and most popular birding sites in the park. The seeming chaos of vegetation forming the marshes, the tangle of briars along the lakes' edges, the unpruned trees and the muddy shallow lakes combine to make the area an ecological niche favored by the largest variety of birds likely to be seen in the Park. Each element seems essential to the character of the area and its continuance as a natural habitat and recreational site.

South Lake

South Lake is a good site for duck-watching in the winter. The lake usually harbors a number of mallards, American widgeons and coots. The lesser scaup, common golden-eye and European widgeon are here as well. The shrubs and trees on the west side of the lake harbor varied thrush. Hermit thrush, chestnut-backed chickadees and a variety of other small birds inhabit the shrubs and trees on the west side of the lake. The vegetation to the east is dense and is difficult to walk through, making it ideal wildlife habitat.

Middle Lake

Middle Lake is among the most productive areas for birds in Golden Gate Park. During the fall, Virginia and sora rails may be heard from the marsh at the south end of the lake. A large variety of warblers, sparrows, thrushes and other small birds feed in the marsh and along its edge. The eucalyptus and Monterey pines on the west side of the marsh are favored by fall migrants, such as western tanagers, Nashville, MacGillivray's and Townsend's warblers, as well as interesting vagrants, such as black throated blue warbler, American redstart, Tennessee warbler, rose breasted grosbeak and summer tanager. Residents likely to be seen throughout the year include downy woodpecker, brown towhee, Anna's hummingbird and common yellow-throat. The marsh is edged with a jumble of blackberry briars which provide an abundance of food and excellent refuge for these and other species.

A small orchard-like area of hawthorn trees is where robins, cedar wax wings, pine siskins and bushtits are likely to be found. This area is also good for golden crowned sparrows, fox sparrows, song sparrows--including some rather unusual subspecies--and occasional Lincoln's sparrows. The little redwood grove has been a good site for fall warblers.

Western pond turtles use Middle Lake, and carp inhabit the lake.

The duck flock on the lake includes wood ducks and northern shovelers. A single male red head duck appeared in the fall of 1978.

The area near the California bay tree at the south end of the lake is good habitat for finches, towhees and sparrows.

North Lake

North Lake suffers from slow seepage and drought. In the future, it will be necessary to seal the lake to retain it as an important Park resource.

Chickadees, bushtits and warblers can frequently be found in the trees overhanging the path to North Lake. The southwest area is valuable for spring and fall migrants and vagrants. Sightings of American redstart, Tennessee warbler and northern water thrush have been recorded in this area. Some records actually go back to the 1930s, making this one of the earliest known sites for vagrants on the central California coast. Finches, sparrows and winter wrens use this area as well. The marsh provides habitat for common yellow throats, yellow rumped warblers, song sparrows and occasional rails. Before the lake was drained, willows on the islands hosted roosting black-crowned night herons and wood ducks. Downy woodpeckers, red-breasted sapsuckers and other species are likely to be seen in forested areas in the trees near the golf course.

At the north end of the lake, shrubs harbor dark-eyed juncos, fox sparrows and brown towhees. The belted kingfisher is here as well as ducks and gulls. Wood ducks and northern shovelers are regulars here, and there are a few records of ring-billed and Thayer's gull. Violet-green and tree swallows are also here in the spring and summer. The trees across the lake often have hawks, owls and other roosting birds.

Buffalo Paddock

The Buffalo Paddock field has sparrows, finches and blackbirds. Brown headed cowbirds can be seen here frequently. There are a few records of tricolored blackbirds. A red-tailed hawk generally winters in the vicinity of this meadow. A water trough on the west side of the hill is sometimes allowed to overflow, providing a home for common snipe in the tall grass during the wet winter months. The forest surrounding the Buffalo Paddock is good for dark-eyed (Oregon) junco, pygmy and red-breasted nuthatch, brown creeper, yellow-rumped warbler and various woodpeckers. Golden crowned sparrows can frequently be seen near shrubs at the east and west end of the Paddock. The Buffalo Paddock meadow is fenced off, making it a short grass prairie unique to San Francisco.

RECOMMENDATIONS FOR WILDLIFE HABITAT

Desired changes in composition and structure of the Monterey pine, cypress and eucalyptus forests and wildlife populations of the Park will take time. It will be years before the naturalistic forest returns and animals achieve a more favorable balance. Changes should be made, however, to assure the ultimate vision of the west section of the Park as a naturalistic parkland.

The following strategies are recommended to encourage development of suitable wildlife:

- Capture and remove feral animals, especially cats, which are predatory in nature, and restrict domestic animals (cats and dogs) to leashes or designated run areas.
- Monitor snags, dead branches and downed logs. Inform the public of the potential danger in natural forest conditions.
- Provide a more continuous canopy.
- Encourage more native grass ground cover and forest debris.
- Limit human disturbance. Keep the park relatively free of discarded human refuse and encourage visitors in the forest to use provided pathways.
- Post signs and distribute information explaining why the public should not feed wild or feral animals, and the consequences of and penalties for doing so.
- Remove and discourage weeds such as ivy. The planting of California native shrubs and trees will increase both the number and diversity of desirable animal species.
- Complement acacia thickets with native understory and oaks.

RECOMENDATIONS FOR BIRD HABITAT

To maintain diversity and number of birds through improvement of the natural habitat, many of the habitat management strategies currently ongoing at Golden Gate Park should be continued, perhaps even augmented. These and further recommendations are summarized below.

- Leave ground cover intact to provide protective cover and nesting sites for birds, except perhaps in areas where unwanted weeds may be removed in favor of desired or native species. This is also a food source for insects, which in turn become food for many birds.
- Leave inconspicuous brush piles for cover.
- Plant more winter fruit-bearing trees.
- Leave snags, dead trees and branches standing as long as possible, unless they present a danger to people or structures. Many birds resident in Golden Gate

Park *require* dead wood nest holes. Snags are also used as acorn hoards and as lookout, singing, fly-catching and roosting perches.

- Establish nest boxes and platforms for wood ducks and herons near lakes.
- Control non-native predators of ground-nesting birds (e.g., feral cats).
- Avoid tree work on known nest trees during nesting season.
- Conduct systematic bird surveys in spring and summer to better determine the degree and cause of the apparent scarcity of ground-nesting species.
- Encourage a multi-age, structurally diverse forest, with variation in height, density, and age of vegetation. Diverse woodlands provide a greater variety of nest sites than uniform, even-age stands.
- Carefully preserve the woodland edge zone where it borders the meadows for its biotic diversity and for the resources it provides resident birds and south-bound migrants.

Fragmentation of the forest should be avoided. However, the progress of pest birds and other undesirable species can be restrained. The good news is that house sparrows and rock doves, those standard harbingers of urbanization, have made only moderate inroads into existing Golden Gate Park habitats.

Further planned habitat alteration in the Park should consider bird life requirements. Judiciously placed plantings of young oak, Monterey pine, and cypress have already begun in the Park and should be extended to prevent further fragmentation of pine-oak woodland and eucalyptus stands.

Preservation of the eucalyptus component is very important for nectar and insect feeders. These trees are often the only trees which have flowers available in the mid-winter period. The freeze of 1990 demonstrated that when the eucalyptus were killed back, the bird population that depended on nectar and insects experienced similar mortality

California species native to the central coast are also excellent sources of winter food as well as shelter. Native plants with significant food potential should be established throughout the forest.

TABLE I

RECOMMENDATIONS FOR WILDLIFE PLANTING

The California Native Plant Society, Yerba Buena Chapter

TABLE I.

THE CALIFORNIA NATIVE PLANT SOCIETY

Yerba Buena Chapter

Recommendations for wildlife planting, Golden Gate Park Master Plan January 1993

Woody/Semi-Woody

Aesculus californica	CA buckeye
Amelanchier pallida	serviceberry
Arbutus menzies~~s~~ii	madrone
Arctostaphylos tomentosa ssp rosei ssp crustacea"	manzanita
Aristolochia californica	pipevine
Baccharis pilularis ssp pilularis	coyote bush
Berberis pinnata	mahonia
Ceanothus thyrsiflorus	wild lilac
Cornus californica	dogwood
Corylus californica	CA hazelnut
Garrya elliptica	silk tassel bush
Gaultheria shallon	salal
Heteromeles arbutifolia	toyon
Lupinus arboreus	bush lupine
chamissonis	silver bush lupine
albifrons v. collinus	silver mat lupine
variicolor	
Mimulus aurantiacus	bush monkey flower
Myrica californica	CA wax myrtle
Oemleria cerasiformis	oso berry
Prunus emarginata	bitter cherry
demissa v. virginiana	chokecherry
ilicifolia	islay
Quercus agrifolia	coast live oak
chrysolepis	canyon live oak
Rhamnus californica	coffeeberry
crocea	redberry
Ribes divaricatum	
sanguineum v. glutinosum	pink currant
menziesii	
Rosa californica	wild rose
gymnocarpa	wood rose
Rubus parviflorus	thimbleberry
ursinus	native blackberry
Salix lasiandra	
lasiolepis v. bigelovii	arroyo willow
coulterii	Coulter willow
hindsii	
Umbellularia californica	CA bay
Vaccinium ovatum	huckleberry
Juncus balticus/leseurii	creeping rush
effusus	rush
xiphioides group	iris-leaved rush
Sambucus mexicana	blue elderberry

Wet (in or at edge of water)

Equisetum hyemale	horsetail/scouring rush
telmateia	horsetail/scouring rush
Typha angustifolia	
domingensis	cat-tails
latifolia	
Carex spp	sedges
Scirpus spp	tules
Sparganium eurycarpum	bur-reed
Nuphar polysepalum	pond lily
Jussiaea peploides	
Heracleum lanatum	cow parsnip
Oenanthe sarmentosa	water parsley
Menyanthes trifoliata	buckbean
Mimulus guttatus	monkey flower
cardinalis	scarlet monkey flower
Potentilla egedii v. grandis	silverleaf
Stachys chamissonis	
Sisyrinchium californicum	golden-eyed grass
Polygonum coccineum	scarlet smartweed
Ferns:	
~~Polystichum munitum~~	
Woodwardia fimbriatum	chain fern

Semi-moist

Iris longipetala	
Salvia spathacea	hummingbird sage
Rumex crassus	native dock
salicifolius	native dock
Aquilegia formosa	columbine
Thalictrum polycarpum	meadow rue
Dicentra formosa	bleeding heart
Cardamine integrifolia	milkmaids
Tellima grandiflora	fringe cups
Fragaria californica	CA strawberry
Cynoglossum grande	houndstongue
Satureja douglasii	yerba buena
Stachys bullata	
Solanum umbelliferum	blue witch
douglasii	
Symphoricarpos rivularis	snowberry
Agoseris apargidoides/ grandiflora	native dandelions
Anaphalis margaritacea	pearly everlasting
Artemisia douglasii	mugwort
Aster chilensis	
radulinus	
Erigeron glaucus	seaside daisy
Helenium puberulum	sneezeweed
Senecio aronicoides	
Polystichum munitum	sword fern
Juncus patens	blue rush

Dry

Achillea millefolium	yarrow
Amsinckia intermedia	
spectabilis	fiddlenecks
Anaphalis margaritacea	pearly everlasting
Angelica hendersonii	angelica
Armeria maritima	sea pink
Agoseris apargioides	native dandelion
Artemisia californica	CA sagebrush
pycnocephala	dune sagebrush
Asclepias speciosa	milkweed
Astragalus nuttallii v. virgata	locoweed
Brodiaea laxa	Ithuriel's spear
pulchella	blue dicks
Calystegia occidentalis	native morning glory
subacaulis	stemless morning glory
Camissonia cheiranthifolia	beach evening primrose
Castilleia franciscana	Franciscan paint brush
latifolia	paint brush
Chrysopsis villosa v. bolanderi	golden aster
Cirsium occidentalis	native thistle
quercetorum	brownie thistle
Corethrogyne californica	
Dichondra donnelliana	dichondra
Dudleya farinosa	dudleya
Erigeron foliosus	
glaucus	seaside daisy
Eriogonum latifolium	coast buckwheat
Eriophyllum confertiflorum	golden yarrow
staechadifolium	lizard tail
Erysimum franciscanum	Franciscan wallflower
Fragaria chiloense	beach strawberry
Galium nutallianum	bedstraw
Gilia capitata ssp chamissonis	blue gilia
Gnaphalium spp	cudweed
Grindelia hirsutula	
maritima	SF gum plant
Haplopappus ericoides	mock heather
Horkelia californica	
Iris douglasiana	Douglas iris
Lathyrus vestita v. bolanderi	native sweet pea
Ligusticum apiifolium	lovage
Lotus scoparius	deerweed
Luzula multiflora	wood rush
Marah oregonus (not fabaceus)	wild cucumber, manroot
Monardella villosa v. bolanderi	coyote mint
Oenothera hookeri	evening primrose
Perideridia kelloggii	yampah
Potentilla glandulosa	potentilla
Phacelia californica	
distans	
malvaefolia	
Prunella vulgaris	self-heal
Ranunculus californica	CA buttercup
Sanicula crassicaulis	Pacific sanicle
Satureja douglasii	yerba buena
Scrophularia californica	bee plant
Sedum spathulifolium	sedum
Sidalcea malvaefolia	checker bloom

Sisyrinchium bellum	blue-eyed grass
Solidago californica	goldenrod
canadensis	"
spathulata	
Stachys ajugoides	wood mint
Symphoricarpos mollis	dwarf snowberry
Tanacetum camphoratum	dune tansy
Urtica californica	CA stinging nettle
holosericea	stinging nettle
Vicia americana	vetch
Wyethia angustifolia	mule's ears

Grasses

Bromus carinatus complex	brome
Calamagrostis nutkatensis	Nootka reed grass
Danthonia californica	CA oat grass
Deschampsia caespitosa holciformis	
Elymus glaucus	wild rye
triticoides	
Festuca californica	CA fescue
idahoensis	
rubra	red fescue
Melica californica	melic
Stipa pulchra	purple needle grass

Ferns

Dryopteris arguta	wood fern
Polypodium californicam	CA polypody
scouleri	leather fern
Pteridium aquilinum v. pubescens	bracken fern

TABLE II
SPECIAL HABITAT REQUIREMENTS

Mammals	**Required Habitat**
Western gray squirrel	Nest cavities in snags, oaks
Calif. ground squirrel	Forest openings; friable soil
Botta's pocket gopher	Friable soil; forest openings
Wood rat	Trees/shrubs; litter
Mouse	Friable soils; forest openings; shrubs, grass, forbs
Rabbit	Shrubs, grass, forbs
Raccoon	Snags or hollows; water
Opossum	Snags or hollows; water
Striped skunk	Logs, rock outcrop, snags
Voles	Grasses, sedges
Bats	Trees, snags, water
Birds	**Required Habitat**
Sharp shin hawk	Large trees, cliffs for nesting/ roosting; openings for foraging
Mourning dove	Trees for nesting; nearby water
Stellar's jay	Oaks, cultivated nut trees
Dark-eyed junco	Shrubs, grass-forbs
California quail	Shrubs/grass-forbs; water
Black phoebe	Snags with soft heartwood
Acorn woodpecker	Oaks, large trees
Pigmy nuthatch	Nest cavities; small openings
American robin	Tree openings, water for mud in nest building

APPENDIX C: WOOD RESOURCES

The goal of the forest management plan is to retain trees and to encourage development of disease-free trees. Nature's method of disposing of dead, defective, and overmature trees is to let wood accumulate and fire destroy it. This is efficient in nature but not a feasible option in Golden Gate Park.

TREE REMOVAL AND WOOD DEBRIS

Tree removal at Golden Gate Park presently is restricted to trees that have fallen during storms, where it is required by reforestation activity or where dead or dying trees pose a danger to people and property. Removal work is performed by the Recreation and Park urban forestry staff.

Woody debris at Golden Gate Park has been increasing as the trees become overmature. Volumes of woody debris have substantially increased with the reforestation program.

Bay Area Air Quality Control Board restrictions on the use of in-house landfills for unwanted woody material forced a search for alternative methods of disposal. None of these alternatives are without their drawbacks. Sale of chips for fuel to cogeneration plants has been stymied by delays in plant-building; authorized dumps have proven to be expensive; and landscape use of wood chips requires specialized equipment and personnel.

TREE REMOVAL AND REFORESTATION

Silviculture, the practice of cultivating trees, includes prescriptions for tree removal as necessary to prevent hazards and promote regeneration. Trees generally are to be removed using either single-tree or small group selection methods. Group selection methods encompass a significant number of trees removed from a specific location.

Single-tree selection is recommended primarily for hazard or thinning operations where replanting is not the primary objective and where trees are widely spaced. Group selection is used where forest regeneration is an objective. Successful replanting requires the creation of openings large enough to expose seedlings to direct sunlight.

Using the current level of implementation as identified in the inventory, about 320 trees will be removed annually from Golden Gate Park. Stand thinning and sanitation will necessitate the removal of about 175 individual trees, and 100 trees would be removed through group selection in 20 plots of five acres each scattered throughout the forest.

This program has resulted in an average wood yield of approximately 8,000 cubic feet (MCF) per year. This yield comprises 52,000 board feet (MBF) of sawlogs or 120 bone-dry units (BDU) of energy wood.

WOOD COLLECTION AND PROCESSING

In-forest processing of a fallen tree consists of removing tree limbs and unusable tops. This material is chipped on-site with a portable chipper and distributed nearby for soil enrichment, erosion control, release of seed, or mulching of seedlings. Also, miscellaneous small woody debris is created by normal tree pruning, brush clearing, or single tree removal. The size and structure of this debris require that it be chipped in place and used locally.

To remove large woody debris such as tree stems (logs), root wads, and large branches, the Park employs methods very similar to those used in rural logging, except that in the urban environment more planning and resource protection is required.

The Park uses a large, heavy duty rubber-tire skidder and a winch truck. The winch is used, in conjunction with the skidder or with a winch truck, to move the woody debris to a roadside loading zone. Large logs require specialized equipment for loading onto heavy duty dump trucks or flat bed trucks and to transport them to the log storage yard where they are sorted, chipped, retransferred and/or disposed of.

Hydraulic packing trucks are used in other parts of the city's park system to compress unchipped brushy material, reducing the labor requirement to load brushy material into a packing truck. The packing trucks go directly to contract scavengers for disposal.

Wood Chipping

A whole tree chipping operation was used successfully once, but, since it required a more powerful chipper than in use at Golden Gate Park, an outside contractor was hired. This proved expensive but effective in handling a very large amount of woody debris. The entire pile of wood chips made by the operation were used by the park staff within weeks of their creation.

Wood chips can be used to inhibit the growth of weeds and undesirable vegetation at reforestation sites. This practice also reduces watering costs, prevents erosion, and lowers fire potential. Wood chips can also be applied on pathways and roads to keep the dust down, reduce soil compaction, and enhance the landscape. Chipped approach, but provides chips for landscaping use throughout the citywide Park system. Many gardeners consider these chips superior in quality due to the absence of leafy (green) matter.

Cost of Processing

An economic analysis of processing pine chips was made for the Monterey pine forest in Cambria, Calif. Calculating the cost of the first approach, the study assumed a crew of two operating a portable chipper at a total cost for labor, machinery, and fuel of $55 per hour. In-woods chipping and distribution is then found to cost $30 per bone-dry ton (BDT), exclusive of tree falling costs. Under the second approach, skidding and hauling logs to the storage yard where they are chipped with a stationary chipper will cost approximately $27 per BDT. However, redistributing the chips is expected to cost an additional $50 per BDT, for a total cost of $77 per BDT. On-site use of chips thus represents a savings of $47 per BDT over centralized collection and redistribution.

To compare the value of chips at the storage yard for landscaping use versus market use, consider that the chips would receive a minimum price of $33 per BDT (the fuel wood price), less a round-trip hauling cost of approximately $10 from the Golden Gate Park to San Jose, for a net market value of $23 per BDT at the storage yard. Marketing chips would thus result in a net savings of at least $73 per BDT, primarily by avoiding the $50 BDT cost of redistributing chips. This analysis does not take into consideration the substantial erosion control, compaction, and landscaping benefits the chips can provide. Quality chips bought on the open market cost $65 per ton, delivered.

CONCLUSION

Sale of waste wood to electrical cogeneration plants and use of wood chips for erosion control and soil amendments appear to be the best options for handling wood debris at this time.